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ABSTRACT

This paper reports on a model in which graduate students were encouraged to regard their classrooms as laboratories to replicate earlier research on the use of examples in teaching concepts. The De Cecco and Crawford (1974) concept teaching model, which requires teachers to define the attributes and values of concepts and to reduce the number of attributes to be learned in complex concepts, is examined, illustrated with examples from student reports. On completion of the lesson, student teachers provided an immediate evaluation of how it affected them and what they perceived their students' responses to be. A week later they prepared a formal evaluation based on classroom data and on observations from additional readings describing alternative approaches to teaching concepts. Between 1984 and 1996, 1,111 reports were completed. While no two reports were the same, similar successes and difficulties were experienced. Topics covered include: (1) use of negative examples in learning; (2) selecting non-examples; (3) avoiding confusion; (4) effects of "noise" (information overload) on the teaching of concepts; and (5) problems in the selection of examples. Taken together, the reports and questionnaires indicate the value of the seven-stage lesson plan and affirm the results of the early research on the use of examples and non-examples in teaching concepts. (Contains 20 references.) (ND)

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On the value of replicating forgotten research on the teaching of concepts during graduate student teaching practice

ED 406 332

by

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1. Introduction.

Many graduates who attend courses of teacher training do so for the purpose of obtaining a licence which qualifies them to teach. They are rather more concerned with passing the examination than with trying out the ideas put to them in their classes and many believe that universities are ivory towers offering courses which are not very relevant to classroom practice. While there may be some truth in this axiom there is much that can be done to create a bridge between theory and practice. Valuable ideas from past research are ignored partly because of such attitudes and partly because students become overwhelmed by new knowledge which may not focus on these issues. There are many possible solutions to this problem and one is described in this paper.

As part of a diploma programme for graduates to qualify as teachers of 12 - 18 year old pupils in secondary schools (also accepted by managements for teaching in comprehensive, community and vocational schools) a course was offered in the Applied Psychology of Instruction. It was examined by a traditional three hour written essay examination at the end of the one year course of training.

Although some success was obtained from questions designed to force the students to illustrate their judgements about theories and models of instruction from their own experience (Heywood, 1992) this was deemed to be unsatisfactory. So from 1984 the examination requirements were gradually reduced and replaced by coursework assessment. From 1988 this consisted of six major exercises which they had to complete as part of their teaching practice. The model was based on that of teacher as researcher and these graduate students were encouraged to regard their classrooms as laboratories for research. In this particular exercise which was the first in the yearly sequence they were asked to try and partially (semi) replicate one of the early researches on the use of examples in the teaching of concepts. Details of the syllabus (content and assessment requirements with instructions have been given elsewhere (Heywood, 1996).

In this one year programme the student teachers teach a class or classes throughout the school year and are in school for two and a half days each

week. During the university terms the students spend the other two and a half days in college. Theoretically the possibilities for integration are considerable and some of this is achieved in workshops in the subjects they teach. All of these graduates will have spent 3 or 4 years studying only one or two subjects and it is expected they will teach this (these) subject(s) in school. They are subject specialists.

Irrespective of their specialism this course in instructional theory and practice was compulsory for all students in the diploma programme.The subjects taught were Irish, English, Mathematics, Business Studies, French, German, Spanish, History, Geography, Music, Religious Education and Science (Biology, Chemistry and Physics in the Senior Cycle).The numbers teaching each of these subjects varies from year and since they are relatively small, the total cohort being of the order 100, no attempt has been made in this paper to distinguish between the different subjects. Aggregates are presented. No evidence has been found to suggest that these activities are subject dependent even though a few students in each year feel this might be the case.

The system of education in Ireland is managed by the State. Post-Primary (Elementary) education follows two cycles both of which end in a public examination papers being set for each of the subjects in the curriculum.The junior cycle is from 12 to 15 years at the end of which the students take the Junior Certificate Examination: the senior cycle is from 15 to 18 years leading to the Leaving Certificate Examination the results of which are the means of selection to university. A more vocational route is also available in the senior cycle.

The graduate student teachers are not generally allowed by schools to take examination year classes. In the past most of them have been confined to taking classes in the first and second years. However many schools are now encouraging them to take classes in the senior cycle especially in the newly introduced transition year for 15 to 16 year olds.Generally they take responsibility for teaching one or two classes throughout the year subject to direction from the responsible subject teacher who will then leave them to get on with the job.

The State Schools (comprehensive,community and vocational) are Co-Ed whereas the secondary schools which are run by religious denominational groupings and in the majority are more often than not single sex. These graduate student teachers are to be found in all types of school but the majority will be in secondary schools.

2. The Experiment.

This experiment was conducted with each cohort between 1984 and 1996. It was always the first one of the year and was carried within twelve weeks

of students beginning teaching. The scale of the exercise was considerable as may be judged from the assessment schedule shown in exhibit 1. The student teachers were asked to undertake assigned readings which consisted of extracts from two books (de Cecco and Crawford, 1974; McDonald, 1969). These summarised research on the teaching of concepts by examples especially as it related to the use of non-examples and the sequencing of examples and non-examples in the teaching of concepts. de Cecco and Crawford also included definitions of concepts and a lesson scheme for the teaching of concepts (exhibit 2) The student teachers were asked to replicate in so far as was possible one of investigations reported in the readings. It was appreciated that at that stage in their course and also because of circumstances which prevail in schools it would not be possible to undertake an actual replication but that it would be possible to teach a concept or concepts using different methods taken from the literature.

In recent years prior lectures have been given on practice and problems with such research (methods limitations, assumptions etc.,) and these were summarised in the syllabus (see appendix of Heywood, 1996 for details).One result was that by 1996 quite sophisticated approaches were being taken to the comparison of two methods of teaching concepts. However, these seem to lead to similar conclusions about the use of examples in teaching concepts as were found among student teachers who used less sophisticated approaches. A typical example of a lesson plan using two approaches is shown in exhibit 3. The student also used a concept map in planning the lesson.

The student teachers were required to summarise the literature and to say which experiment they proposed to try and (semi)- replicate. They were at liberty to choose their own hypothesis within the general remit if they so wished. Having done this they were to state the aims and objectives of the lesson, show how they intended to check the theory by lesson plan and design. On completion of the lesson they were to provide an immediate evaluation of how it affected them and what they perceived their pupils responses to be. A week or so later they were to administer the test and subsequently write a formal evaluation on the basis of the data available which in addition to their own results and observations included another reading describing possible alternative approaches to teaching concepts Howard, 1987). They were asked to say, if having read this new material, they would have chosen an alternative approach to teaching the concept. They also had to comment on the assumptions they made in conducting this piece of classroom research and its limitations together with a statement of the impact it had had on them.

All this resulted in very substantial reports which were assessed by the tutor (this writer) within a three week period. During the period 1984 - 1996 one thousand one hundred and eleven reports were completed, and from

1989 when the detailed assessment schedules were introduced 694 were completed (on average 99 per year). It will be argued that because this exercise has been reported on so many occasions that it is possible from an analysis of these reports to draw some general conclusions about the validity of these early commentaries on concept learning to present day teaching. Some support may also be obtained from questionnaires that were issued at the time the reports were handed back in 1991, 1992 and 1993. They sought to obtain simple aggregates about some key issues. There were considerable differences between the 1991 and 1992 / 1993 questionnaires. In 1996 a quite different instrument requested the students to summarise their findings. Unfortunately so many different teaching methods were used that only limited conclusions may be drawn. However like the earlier questionnaires they lend support to the findings of earlier research and in particular to stage 4 and 5 of the de Cecco and Crawford model.

For these reasons this evaluation is based primarily on my assessment and interpretation of the reports with supporting examples, but reference is also made from time to some of the questionnaire findings.

Over the years it has been found that these reports contain some wonderful insights. At the same time no two reports are the same. However, it seems that each cohort experienced similar successes and difficulties to the other cohorts making possible some limited generalisation. It will be concluded that the early research on concept learning remains highly relevant.

One or two students in each year have thought that the purpose of the investigation was to evaluate de Cecco and Crawford's lesson scheme for teaching concepts. This did not negate their enquiry for as exhibit 2 shows the students had necessarily to conduct the evaluation as part of stages 4 and 5 of the scheme. Since many students found the scheme very useful the observations relating to this evaluation will be presented within the framework of that scheme. But first why is concept learning so important.

3. The Importance of Concept Learning

Concepts are the practical outcomes of the schema we acquire and we may like to think of these in terms of frames of reference (organisations of concepts) upon which we can call. Without concepts we would be unable to handle all the knowledge available to us. They are the means by which we discriminate one thing from another: they are also the means by which we form categories. Their functions are therefore to help us to reduce the complexity of the environment through the identification of the objects in the world around us and, with these to build up networks (semantic maps and trees;scaffolds) of concepts with which to examine the world in which we live and appraise the new knowledge which 'comes' to us daily.

If the constructivist movement in science and maths education has made nothing else clear it has shown just how difficult it is to learn concepts. It is all to easy to misperceive and this applies to every subject in the curriculum. It is more worrying to find that many graduate student teachers come from their college studies without an understanding of the significance of concepts in learning. In consequence the concept learning exercise comes as a surprise. The students find it difficult to think in terms of concepts or, to appreciate their importance in learning. In one group of 73 graduate student teachers 38% felt that the concept teaching exercise demanded from them a considerable change in attitude toward their teaching but 95% (as did a similar percentage in the previous year) thought it was valuable although evidence from their open-ended answers as well as their lesson reports suggests that the importance of successful concept learning for the learner is not always fully appreciated.

> "I felt that the exercise was of great benefit to me as a teacher in that it gave me a foundation from which to plan my individual lessons - I had a goal to work towards".
>
> "I found the concept lesson showed me the importance of clarity in the material in order to present it effectively".
>
> "The exercise was useful in that it highlighted for me methods that I would normally use and showed me ways of being more effective in using these".
>
> "Concept learning is constructive as it is well structured and laid out. It helps the teacher in the pacing of the lesson".

Few of the students make the kind of jump illustrated in the following:

> "Worthwhile exercise, helped me enormously in getting over the biggest problem I have come across in teaching, to date i.e. getting to the child's level of understanding and viewing their side of things"

Teachers at all levels of education have insufficient understanding of the role of concepts in learning and this is as true of higher education as it is of school as Erickson (1984) has pointed out. It is only when they are faced with exercises such as this that graduates "become aware that a distinction exists between concepts and factual information or, the need for simplification which can be difficult"

> "I learned that simplification can be difficult. As a teacher I liked presenting my pupils with lots of information on any one theme. I had felt this would be of benefit to them. I did not realise I could be creating confusion by making too much "noise". The process of simplification is not any easy one, I learned. We really have to consider the importance of any piece of information on any given topic and our reasons for including it at the expense of excluding possibly more important information".(Katrina Ellis 1990)

More significantly is the fact that in 1992 (N=78) and in 1993 (N=73) 64% and 66% respectively said that they had not considered the issues surrounding the teaching of concepts before they had been asked to undertake this exercise. However, 60% and 82% respectively said that the exercise had caused them to revise their approaches to teaching in general.

It is clear from an analysis of the reports that some teachers did not believe the exercise applied to their subject area and this was particularly true of modern language teachers. Some remain sceptical of the exercise after its completion. However, many of them become convinced of the value of the exercise. For example.

"Prior to our induction course it would not have occurred to me to consider that the teaching of French Grammar could be looked on as a topic for concept learning. However on reflection it is clear that the whole notion of time and tenses in language consists of a group of concepts and that in dealing with the near future it was the overall idea of future time that was the cornerstone of the lesson. Whether other aspects of language teaching can be so readily classified is not yet clear to me" (Carol Moran, 1990).

Mairead Mannion (1988) who taught a concept in German to 13 year olds found it helpful in making the teacher more aware of what how h/she actually teaches. But

"care should be taken not to be too rash in making such generalisations. Despite the benefits I have gained from concept theory in developing my own learning theory for teaching (and indeed learning), I do remain sceptical of its direct applicability to foreign language teaching. Presuming that one cannot teach them a concept in L_1 without them knowing it first in L_1 what you are teaching them in L_2 is then surely nothing new - apart from the fact that you may be reinforcing their ideas on the concept in question and helping them to abandon stereotypical views? I would see the main task of the language teacher in facilitating the actual acquisition of L_2".

In contrast a mature student with some prior experience of teaching wrote

"When learning a language such as Spanish from scratch at the age of 13/14 a certain amount of prior knowledge is assumed, both grammatically and conceptually, in the Mother Tongue". "Gagné says that each individual stimulus must have been previously acquired in English before it can be transferred to another language".

"He says "In the learning of language rules, a point deserving great emphasis is the importance of prerequisites. And the necessary prerequisites ..... are concepts. The contents of the rules in the form of phrases, sentences and conversations are, of course, the concepts of the foreign language i.e. its words in their conceptual form. "It should be almost self evident that ideas cannot be expressed unless one has previously learned their unitary parts. Thus the learning of vocabulary is of considerable importance in facilitating the learning of rules of grammar and syntax. The greater the number of verbal concepts one knows, the easier it should be to learn the required rules of language structure. B.V. Belyayev makes the point in "The Psychology of Teaching Foreign Languages" that "the reason why teaching a foreign language is difficult is that pupils must grasp a different system of concepts, which do not always coincide in content or scope with the system of familiar concepts expressed by words in the native language. A child familiar with a concept in English gradually, through a process of learning to think in the foreign language, becomes able to transfer the concept into a different but accurate representative concept in the foreign language. For this reason, learning a foreign language is exciting in that learning to think in the foreign language opens up new expressions of concepts. The knack for this is achieved not only by learning rules, and learning by rote, but also by being open to concepts and concept variations in the foreign language. Examples of different concepts in a foreign language are as follows. Spaniards use a single word to denote two opposite phenomena, merely giving it the endings of masculine and feminine gender, as in "abuelo/abuela", "hermano/hermana", "chico/chica", "novio/novia". (Moira Hearn, 1993).

Given that these student teachers had to undertake this exercise within one month of the beginning of their post-graduate programme in teaching we should not, perhaps, be too dismayed. The first step in helping students (of

all ages) to understand concepts is for the teacher to understand their importance in learning and, to appreciate that concept learning often requires more time than they allow.

The sections which follow will summarise by illustration student responses to the de Cecco and Crawford lesson scheme beginning with Stage 2.

4. Stage 2 of the de Cecco and Crawford Scheme for Teaching a Concept.

Stage 2 requires the teacher to define the attributes and values of the concept and to reduce the number of attributes to be learned in complex concepts.

This is evidently very helpful advice. At any age when learning a new concept the learner is likely to try and simplify the concept. To put it in another way concepts that appear simple to some mature learners may not appear to be so simple to other equally mature learners when they come across them for the first time. Evidently student teachers find it difficult to analyse concepts in this way. Only 22% (1992 group) and 18% (1993 group) taught their students to analyse concepts for their attributes and values, and of these around half found it difficult to define the attributes and values of the concept taught. Nevertheless many of the reports show that irrespective of whether the pupils are taught such analysis it can be of value in lesson planning as the following examples demonstrate.

Two of the concepts which confuse people of all ages are "primary sources of evidence" and "primary causes of events" be they in history, the politics of the present or, a court of law. The debates which range among experts about the desirability or otherwise of American intervention in Europe, the Persian Gulf, Korea and Vietnam are littered with different views of primary causes. Of such stuff is revisionist history made.

The selection of attributes is not only effected by the age of the learner but to the prior knowledge and skill of the learner.

David Clarke (1993) points out that

> "primary sources" is a confusing concept because it can be viewed as both a conjunctive and a relational concept. In so far as twelve and thirteen year olds are concerned to try and deal with both would lead to confusion. Thus one deals with secondary sources on another occasion."

For his lesson he selected the dominant attributes of 'time' and 'form' .He also included the rather more obscure attribute of 'meaning'; for the understanding of the concept to be relatively complete.

One of the difficulties which teachers have is that in the absence of any agreed syllabus they may take a different view of the attributes of a concept. Leo Larkin (1991) took the view that the key attributes of a primary source were (1) it is evidence and (2) that it is received directly/first hand. The way in which the attributes are perceived may well

dictate the whole approach to the lesson although the use of examples and non-examples might well lead to the same outcomes. In his lesson a mix of examples and non-examples were presented (an old building, a newspaper, an object, a film, a photograph and, a diary).

Also in History, Bob Kenny, (1993) identified the attributes and values of the concept "Monastery". He wrote

"In identifying the dominant characteristics I used the criterion of relevance for the overall aim of the series of lessons, namely "To further the class's understanding of the nature of religious change in England during the 16th century". In this context the most important attributes were those which would help the pupils to understand why Henry VIIIth decided to close the monasteries. Therefore, I decided that religion, membership, means of support and administration were the dominant attributes".

The difficulties involved in teaching concepts in a foreign language have already been mentioned. Jacqueline Kiernan (1993) felt

"that teaching a concept in a foreign language is different to teaching a concept in any other subject as it is based on the premise that the student knows the concept already in his/her mother tongue. Therefore, in the foreign language the teacher is merely providing the means to express the concept in another language".

The concept she chose to teach was the verb *'avoir'*. *She* felt that making some values more dominant than others (i.e. age and the 8 states) that the students would be able to grasp the concept. They would then, in the future, be able to recognise more examples of the use of the verb *'avoir'*. In her report she said the exercise also showed the need to constantly explain in order to reduce complexity. She wrote:

"The dominance of the attributes is difficult to classify but the form must be emphasised aurally and visually while the meaning may be more obvious. The pupil would be able to guess the meaning from the context while the form would be more difficult to ascertain, e.g. "Elle s'appelle Tammy. Elle --- 10 ans".

The meaning of age is more dominant than knowing the correct form bf the verb *'avoir'*.

The concept of *'avoir'* and its uses can be defined as a conjunctive concept as the appropriate values of the two attributes [i.e form and meaning] must be present. The uses of knowing and understanding this concept are many. By forming a class of stimuli, the complexity of French idioms is reduced and in the future students will be able to recognise the attributes of similar phrases

e.g. To be ashamed - '*Avoir honte*'

Once the basic list exists, it can be continually added to. The need to constantly explain and learn is reduced considerably, the pupil is given direction and will know how to apply the phrase correctly

e.g. He is ashamed - '*Il a honte*'

You are ashamed - '*Tu as honte*'".

Antonia Kelly (1993) also taught French but to seventeen year old students of Hotel and Catering, most of whom had studied some French before. She wished to teach the concept 'pronoun' and identified seven attributes. She chose to attend to some attributes and ignore others .She wrote:

"James Archer found that when the attributes of size and shape were important for recognising the concept, and obvious, the mastery of the concept was easy. Mastery of the concept

was most difficult when the attributes were not obvious. I have found that emphasising three of the seven characteristics I mentioned above, guided the students to a better understanding of the use of pronouns, namely

(a) Size - all monosyllabic words - usually 2 or 3 letters
(b) Position - before verb in a sentence
(c) Meaning - replace nouns and give specific information about those nouns.

I have found, as de Cecco and Crawford mention, that students more easily attend to some parts than others, and in the order that I have listed them. The most common mistake is to position them correctly and then to mix up gender. Therefore, I have put extra emphasis on highlighting these attributes".

The value of this approach to concept learning is also evident in the teaching of Latin.

Ann Geraghty (1991) who taught the passive voice in Latin to 13 year olds summarises her reaction to these fundamentals as follows:

"An attribute is a distinctive feature of a concept and thus varies from concept to concept. The distinctive features of my concept were that in the passive voice the subject receives the action of the verb, and in Latin this is shown by adding passive endings to the verb so that it may be recognised as such".

"Concepts vary in the number of values their attributes have. The example given was that of a human being (concept) which can be married or single, male or female. This helped me decide on the attribute values of my concept. It could be singular or plural in number, it could be a masculine, feminine or neuter gender and it could have an indicative or subjunctive mood, or any of the six tenses, present, future, perfect, imperfect, pluperfect, future perfect".

"The research work of James Archer (1962) and John Wall (1964) alerted me to the fact that the greater the number of attributes a concept possesses, the more difficult the learning of the concept becomes as scanning a high number of attributes is time consuming and makes one's concept seem more obscure. Students, it has been found, learn concepts with dominant, i.e. obvious attributes with significantly few examples that are needed to learn obscure attributes. Therefore, I decided to make dominant the attribute values of singular or plural and to only introduce students to verbs which are passive in the present, future or imperfect tenses and in the indicative mood. In other words to keep attribute values in the range of their experience".

In Geography Michael Ashmore (1991) when teaching the concept of "clouds" ignored the more difficult attributes of structure, moisture content, and electrical charge and concentrated on those which could easily be explained to twelve and thirteen year old children i.e. the attributes of height, shape and colour (. Although he pointed out other attributes of a "trawler" T. Morgan (1989) concentrated on the derrick, the trawl derrick and the trawl net and found that by

"pointing out its dominant attributes and giving positive and negative examples it quickened up the learning process and greater progress was possible" . . . . "this is especially so when the students grasp the concept correctly and can 'modify all their interpretative frameworks' via this concept". Thus for example, with the concept "trawler, further progress will be made in discussing fishing and the fishing industry and more knowledge can be added to the concept".

Even if a student teacher finds it difficult to define the attributes and values of a concept the fact that they are forced to think about their dominant features is an aid to the planning and implementation of a lesson.

"I found that introducing the students to the concept *Genes* and also being forced to restrict the number of major points made in the class provided a good starting point to give a fundamental but clear understanding of this topic. It made me see that no matter how complex and involved the topic is, it is always possible to simplify it for clarity and yet get the main points across". (Ann Moynan, 1985).

It will be evident from the forgoing that part of the skill in discrimination is the ability to recognise that while an attribute is a distinctive feature of a concept the same attribute value may vary when it is found in other concepts. The number of attributes varies between concepts.

It is also evident from these reports as well as much anecdotal evidence from experienced teachers that part of the confusion the average student finds in learning concepts in higher education as well as school is that many tutors do not take a step by step approach and ensure that the students understand the dominant attributes first. Unfortunately this takes time and tutors are more often than not unwilling to give the time required for understanding because of beliefs about the need to cover the syllabus. The significance of concepts is not understood. 50% and 49% of the student teachers in 1992 and 1993 (41% in 1991) reported that concepts teaching took more time than the teaching they normally undertook.

5. Stage 3. Verbal and Visual Mediation

Stage 3 of the de Cecco and Crawford model requires the student to be provided with useful verbal mediators. According to Jensen (1966) "verbal mediation is talking to yourself in relevant ways when faced with something to be learned or a problem to be solved". . We talk to ourselves in classes and lectures and sometimes the comments are audible. In their naturalistic studies of individual children in classrooms in New Zealand, Nuthall and Alton-Lee (1992) report that the second most frequent type of utterance in the classroom was talking to self. Although the comments were not related to anyone in particular they, by and large, related to the public discussion in the classroom. "They consisted of answering or repeating the teachers' questions, repeating the answer given by another student, making associations with the public content, referring to related personal experience or making puns of wordplays".

The reports of my student teachers indicate that this is quite normal in the classroom. Private talk and Peer talk are important components of learning.

As long ago as 1935 Miller demonstrated how what we say to ourselves can act as an internal stimulus to a public act. It is a matter of reflection to observe that we think before we act, and Luria and Yudovitch (1971) have demonstrated the power of internal speech on behaviour

Teachers can help students to mediate by interventions in the learning. These can be oral, aural and visual.

The implication is that sometimes we understand even though we cannot articulate that understanding.

In the Latin class previously mentioned Ann Geraghty reported that step 3 of the de Cecco and Crawford lesson scheme required her to prepare the student for concept learning and to ascertain the students knowledge of the words used as attributes and attribute values as well as the relational words

"For me this meant ensuring that the student had acquired the concept of the Active Voice and understood the term transitive verb. Up to now each student had only dealt with active verbs but they might not be aware of the practice of applying the terms active or passive depending on whether the subject performs the action of the verb or receives it. By looking at these two aspects in English we can then proceed to look at the passive voice in Latin. Proceeding from English to Latin should help contextualise the lesson with regard to our own language and then with regard to a classical language. Any verb used in the passive voice must be transitive. Each student has already used verbs taking direct objects but they may not be familiar with the term transitive which applies to such verbs. This must be reinforced at the outset because in the passive voice what had been the object of the transitive verb, now becomes the subject of the passive verb (still receiving the action of the verb)".

Michael O'Loughlin (1985) wanted to teach a group of fifteen year olds the idea of unconditional loops in computer programming. He was teaching them Basic

"I had analysed the concept "loop": it is a relational concept because it has the effect of changing the flow of programme execution. The dominant attributes of the concept "loop" I take to be: purpose, direction, number and size. Its purpose is repetition; its direction is forward until the end of the loop, then start again, its number varies and continues to rise until there is a break in the programme (the user presses the 'break' key or the power is cut off); its size also varies:.

"Considerable evidence indicates labels (as verbal mediators) facilitates the students learning of a concept". (De Cecco and Crawford, 1974). I wrote down the word "loop" on the board together with other words which help give an understanding of the concept: "jump", "repetition", "unconditional" and "infinite".

It is important to appreciate that the need for verbal mediation applies at all levels of education especially where students have to deal with abstract concepts. The example below is of the use of a verbal mediator in a history class for 17-18 year olds. They would have studied history for four years. The concept considered was that of fascism. In his evaluation of his class G Fitzpatrick (1985) said of Stage 3 :

"Did I provide the class with verbal mediators? At the beginning of the class, we recalled the necessary preliminary concepts to be used as building blocks for the learning of the concept (Gagné). In our discussion of the 5 attributes I questioned the students on the meaning of any complex words or concepts. Fortunately these students are capable of operating at the symbolic level of concept learning (Bruner). An example of a helpful suggestion from a student relates to the understanding of the concept of totalitarianism, one of the attributes we had listed of fascism. His advice to his fellow students to focus in on the element 'total' to jog the memory was recalled by another student some weeks later in our study of Nazi Germany in response to a need to define totalitarianism again".

Visual (pictorial mediation) is a major mechanism for learning used by the media. It is equally valuable in the classroom at every level of education.

Teachers of mathematics often resort to pictures particularly when they are helping students to learn about sets. A picture of a sports team may be shown or, as I have seen a picture of cows but these are well defined sets and students sometimes have difficulty in recognising poorly defined sets.

Other forms of mediation have been used with young children and these, de Cecco and Crawford point out, dispute the myth that young children can learn concepts best with little or no instructional guidance (Wittrock and Keislar, 1965).

This stage is a reminder that the entering characteristics of the students have to be understood if the learning is to be meaningful. This is particularly important in situations of school transfer, where for example, children transfer from primary (elementary) to junior secondary (junior high school). Teachers in the junior secondary school can easily assume that their new students have either more or less knowledge than is required for their lessons. The mismatch can be particularly disastrous for a lesson. One has to start at where the pupils are at without causing confusion. Thus when Jacqueline Keenan (see above) wanted to teach the concept 'Avoir' in French because the class of twelve and thirteen year olds had only limited vocabulary she wished to avoid having to teach them a new grammatical structure. Therefore, she decided to teach them the different attributes of the verb avoir as the form of the verb had been covered in an earlier lesson e.g. "he has a book - il a un livre"; they have a pencil - ils ont un crayon".

"The verb *avoir* is also used to express age! and as this was to be introduced next in the textbook, I decided to teach this concept and to introduce and express different states using this verb. For the purpose of my lesson I decided to limit these states to six. (to be hungry - Avoir faire; . . . thirsty - soif; . . . hot - chaud; . . . right - raison; . . . wrong - tort)".

Another example of its use in teaching French is given by Charlotte Callaghan (1991).

"I will write 'il pleut' (it is raining) 'le temps' and all the phraseology in relation to the weather that I present on the blackboard. This is necessary so that the pupils are given the verbal association. Ask the pupil in each case to say the new word first of all, they do this chorally and then at random individually. It is essential that a new word is introduced in a way that each pupil can learn from. Initially, I say the word, (the speaking skill) the pupil listens to it (listening skill) the pupil says the new word (speaking skill) and then the pupil writes it down (writing skill). Finally, the pupil reads the new word (reading skill). All the four skills i.e. listening, speaking, reading and writing are incorporated into the introduction of a new word".

As indicated teachers sometimes seriously misjudge the entering characteristics of their students to the detriment of the lesson. Elizabeth O'Neill (1989) wrote about teaching the separable verb in German that

"I found that there was still a great deal of confusion regarding regular verb endings which meant that I had to reinforce them before I could continue. I had also assumed that the meaning of terms such as "prefix" and "noun" were familiar to them. This was not the case, and further time was needed to explain these".

These misunderstandings occur particularly at times of transition (primary to post-primary; post-primary to university). The expectations of post-primary and university teachers are often set too high.

Pictorial mediators are evidently very successful with young children as they are in modern language learning but as children get older and ideas become more complex verbal mediators become more important even in subjects like music. This problem is illustrated by Ciara Vaughan (1993) who wished to teach the conjunctive concept 'pitch' to a group of twelve and thirteen year olds. As he explains no further development was possible without verbal mediation. The class had already learnt Solfa handsigns and the eight solfa notes. They could sing, moving by step, but had not yet learned how to sing in intervals. He recorded that

> "the class made a good attempt to define 'pitch'. With some prompting on my part, they suggested the dominant attributes, but they lacked the verbal mediators, which I then provided. The class seemed to grasp the labels: range, dynamics, but had slight difficulty in applying the idea of accented and unaccented notes. However, after we examined some of the songs on the course especially the folksong "click go the shears', they seemed to understand the meaning better".

6. Stages 4 and 5. <u>The Provision of Positive and Negative Examples and non-examples.</u>

The point at issue in the paragraphs which follow is whether the early research on the presentation and sequencing of examples and non-examples continues to have relevance. Since both stages 4 and 5 are concerned with the provision and sequencing of examples they are considered together in this section.

Stage 4 is to provide positive and negative examples in terms of appropriate numbers and realism. (Some authorities prefer the terms example and non-example. Other reports refer to similar and dissimilar examples. Stage 5 is to present the examples in close succession or simultaneously.

At the time de Cecco and Crawford wrote research workers had attempted to answer such questions as - "do students learn a concept better if they are only presented with positive examples than when they are presented with a mix of positive and negative examples"? How many examples should be used in concept learning? Can a student learn from a negative (non) example only?

Three of the investigations which lead to the view that a mix of positive and negative examples should be used were due to Smoke (1933), Huttenlocher (1962) and E. Olsen (1963). It was Yudin and Kates (1963) who concluded that negative examples only help learning when some positive example accompanied them: their findings supported Brayley (1963) who reported that the students understanding of the positive example has to be relatively strong before the negative example can help develop powers of discrimination. Moreover, the provision of negative examples alone places a

great deal of stress on the learner. Arnold Buss (1950) found in slight contradiction that the example (positive and negative) which the students use had a powerful effect on learning.

(i) The Use of Negative Examples in Learning

Kevin Reilly (1991) when teaching the concept of archaeology to a mixed class of twelve year olds found that the simultaneous presentation of positive and negative examples was helpful. He wrote:

"The usefulness of negative examples was something which gave the pupils an opportunity to develop their powers of discrimination as negative examples omitted certain attributes and consequently a range of values. The ability of a pupil to recognise negative examples placed him or her firmly on the road to learning the concept".

In the same vein Julie Kellie (1985) when teaching the "collective noun" in English found that:

"the negative examples help the pupils see where they are going wrong themselves. Any of the examples I gave, I had picked out from their essays. So they were in fact applying the concept to their own work".

Another illustration of the value of non-examples comes from Elva Miller (1993) who when teaching the concept of "living things" gave both positive and non-examples. When she tested the students she found that most of them

"were able to successfully identify these examples and non-examples with one exception. The non-example 'hair' was not properly identified as dead. After discussion with the class after the test, I realised that the students thought of 'hair' as growing and therefore living".

It is a pity I could not ask her to follow this up with another test some months later because she might have found that the idea of hair as living might still be prevalent among the class for, as we know, scientific perceptions although false often persist.

Some student-teachers see the inclusion of non-examples as essential. In foreign languages as Gillian Harte (1993) explains the concept of "negative" is important. Thus she considered

"the presentation of non-examples fundamental to the teaching and learning of the concept of "negatives". Thus for every example of a negative word/sentence that I will present to the class, I will follow it by a non-example of a positive sentence in Spanish

No Tengo Nada Amora
I don't have anything now.
Tengo Algo Ahora
I have something now".

Unfortunately her class was rather too small to evaluate her approach but she concluded that it was sensible to give an equal number of examples and non-examples.

(ii) Selecting Non-Examples

The choice of non-examples is not a simple matter. 40% and 28% respectively of the students in 1992 and 1993 found the selection of no examples difficult. For example Peter O'Toole (1994) draws attention to the need for careful selection of non-examples particularly in mathematics. At the time he was teaching the concept of a fraction.

"I feel that a non-example should be in some sense similar to the concept. Obviously, a non-example of a concept would be "a chair" but this does not reinforce the definition in any way that I can see. Instead, I expect rows about decimals really being a kind of fraction. If needed, I will discuss a non-repeating infinite decimal as an example".

Moreover it is very easy to fall into the trap of choosing a non-example which has meaning for the teacher and not the student. Rosemary Waugh (1989) pointed out that the use of a non-example which does not mean anything to the student is also misleading. She was teaching the concept of the 'insect' and of the non-example she used was of a 'tick'. She reported that this was

"a mistake because only two of the girls had ever actually seen one. I drew a tick on the board and explained what it was and where it could be found, but I felt that this diversion was distracting for them. After explaining what a tick is, I had to turn round and get back to the point of what an insect is and what it is not".

Katrina Hegarty argued that negative examples have to have a reinforcement value. For example eye and stomach would hardly help to reinforce "lung".

Sometimes the student-teachers ran into the difficulty that the only example they had was of the concept they wanted to teach. Thus Fiona Anderson (1991) who was teaching the earthworm wrote:

"As you can imagine, I experienced tremendous problems at this stage (step 4 of de Cecco and Crawford) because the earthworm was, in fact my only positive example. My negative examples were far too diverse and removed from the concept to be meaningful and complicated matters. Perhaps what I have actually shown is the difficulty involved when learning a concept based purely on negative examples".

(iii) Avoiding Confusion

Fiona created difficulties, as she expressed it, for her students by the "diversity of her examples".

Confusion is so easily caused when teaching concepts. For example,

"I felt I gave very clear examples but on mature recollection, my blackboard work was untidy and not systematically carried through. Obviously it was as a result of this that some pupils

got confused. I only gave one negative example in my lesson which some pupils gave in the test. It was clear that the pupil had not learned and/or understood the formation of how to describe weather conditions (in French). Perhaps, if I had introduced the weather inductively rather than deductively, it might have been better for the pupils". (Charlotte Callaghan, 1991).

Sometimes the wrong non-examples leads to confusion.

"My negative examples of 'digestion' were harder than expected to explain and as a result created some confusion within the pupils mind". (Caroline Cleary, 1990).

It seems evident that if the non-examples are carefully chosen and used to effect that they have an important role to play in the teaching of concepts and this view is supported by some of these semi- replicatory studies which these student-teachers have done.

(iv) The Effects of 'Noise' on the Teaching of Concepts. Information Overload

Confusion may also be caused by the way in which the concept is taught. The teacher may create mental indigestion or noise which drowns the concept. For example Louis Callaghan (1991) was disappointed with a response to a test designed to elicit the understanding of archaeological evidence associated with ancient Egypt. He found that his thirteen year olds could only list at most five objects. This led him to conclude that he

"may have complicated the concept by giving such a detailed description of each example in the presentation. While this made the class more enjoyable for the students they lost sight of the importance of the concept. In addition more time should have been spent reinforcing the pupils responses with positive and negative examples. I realise now that the best course of action would have been to give general examples and non-examples of archaeological evidence e.g. tools, weapons. ornaments etc. from both the past and the present. I could have easily drawn these examples and non-examples on record cards and pinned them up . . . ".

McDonald (1969) describes an investigation by a Soviet scientist Boguslavsky (1957) who reported that when two groups of biology students were taught to identify the parts of flowers by the different means of real flowers on the one hand and diagrams on the other hand : those students who learned the diagram learnt the parts more accurately and easily. They were also more able to transfer their knowledge to real flowers better than the group taught with real flowers. Evidently the real thing drowned the essentials. It created 'noise'.

David Clarke (1993) who read about this research said that

"My work in this history class has recently centred on imaginative descriptions, textual and pictorial of the Celts. They have responded with energy and imagination. However, although these mini-projects certainly bred enthusiasm, my efforts to use their own material to teach concepts, such as 'primary sources' seemed to flounder in their subjective energy for the period. In my planning to provide conditions for enthusiastic response (which he included audio visual tapes), I had over stimulated and failed to provide clear cut examples of the concept. I had not planned to teach the concept and used inappropriately complex examples".

So in his next lesson he used clear line drawings for his examples and non-examples. Even so one has to take care even with simple drawings. Terri Harris (1990) also used diagrams to teach the "flowering plant". The class were asked to draw a diagram of a flowering plant and

> "The definition of an internode appeared to be understood until I checked at the end of the class. Some children thought it was the middle of a stem. I think this idea may have embedded itself because the diagram in the book and my diagram showed an internode at the middle of the stem. I should have marked in more than one internode, perhaps on the top and side branch also to show that an internode can occur anywhere".

These examples also relate to the role of prior experience in learning concepts and a reminder of the importance of the students entering characteristics.

(v) Problems in the Selection of Examples

At the same time it is often difficult to choose good examples. Edel Byrne (1990) in a biology class wanted her class to state whether "something" was living or not as well as to list the main characteristics of living things. She began with the view that positive examples would enable her students to understand the seven processes that characterise living things because she thought negative examples would confuse. She found that, on the contrary, negative examples highlighted these processes. But she felt that she did not achieve her objectives because

> "I think my examples may have been too alike to develop a real sense of the range of living things" (she had used person, dog, plant, bird, fish and tree).

When teaching twelve and thirteen year olds the concept of 'metaphor' Katherine Hennessey (1993) found that the students had great difficulty with the concept and concluded that this was in part due to poor examples. She found that there was much confusion between simile and metaphor among the weaker students who had to be helped by the more able in the class. Since metaphor is also a super ordinate category students have to have a prior knowledge of what an image is. Therefore it would have been better

> "If I had encouraged the students more directly to visualise sentences they were trying to create, using imagery I think they may have understood the concept better. Even though I did make comments about this helpful idea to further their understanding I don't think I emphasised it enough".

From all of the forgoing it seems that these case studies confirm McDonald's (1969) view that students differ in their ability to profit from examples but "more students prefer a mix of positive and negative instances".

It is for this reason that de Cecco and Crawford advocate the provision or positive and negative (non) examples. It is difficult to see how stage 5 can really be separated from stage 4 since if a number of examples are used the issue of sequencing has, in any event, to be resolved. (Stage 5 is to present the examples in close succession or simultaneously). That the sequencing is done quickly is almost dictated by the shortness time of a lesson or lecture; and, the possibility that at least two concepts may have to be learnt in that time. They also recommended simultaneous presentation of examples and non-examples. This may be done on the board or, by means of a work sheet especially where the concept is difficult as for example in the teaching of parasite in a biology class of sixteen year olds. And so on . . .

One approach to this problem of students learning in different ways was suggested by Grace Reddington (1985). As part of a science course she taught the concept of Comet. This was the year of the reappearance of Halley's comet so there was general interest in this phenomenon. Instead of presenting the class with examples and non-examples she got the students to generate ideas about what a comet is. For this purpose she organised the class into groups each of which had to elect a leader.

> "To explain what is required an example is given, "what is a rock like?" answer, "cheese". After writing down their answers the leader will give one answer to the question "What is a comet like? and the list of the analogies is written on the blackboard". Prior to this the student had to read an article in a newspaper on comets. Each group then listed reasons why a comet is like the list of analogies written on the board. The groups also listed reasons why the comet is unlike the list of analogies given and in both cases reasons had to be given. These were all written on the board".

The problem for the teacher, if these researchers are correct is that if learning concepts is a matter of individual preference without some detailed research in his or her own classroom she or he will not know which students learn best by positive examples alone or which students prefer to learn from a mix of positive and negative examples. One way of achieving this goal is to try and partially replicate some of the early experiments as these graduate students did.

7. Theory into Practice: the Sequencing of Examples

Three of the investigations which lead to the view that a mix of positive and negative examples should be used were due to Smoke (1933), Huttenlocher (1962) and E. Olsen (1963). It was Yudin and Kates (1963) who concluded that negative examples only help learning when some positive example accompanied them: their findings supported Brayley (1963) who reported that the students understanding of the positive example has to be relatively strong before the negative example can help develop powers of discrimination. Moreover, the provision of negative examples alone places a great deal of stress on the learner. Arnold Buss (1950) found in slight contradiction that the example (positive and negative) which the students use had a powerful influence on their learning.

It was also Kates and Yudin (1964) who found that simultaneous presentation in which all previous examples remained in view was better for learning than either the successive presentation of examples, or a focused condition in which two examples are presented together. (The first example is always positive, the second is either positive or negative). The reason for the success of simultaneous presentation is thought to be because it puts less strain on the memory.

Smoke's (1933) study in which the merits of learning only positive examples are compared with learning by positive and negative examples is an attractive one which can be done with relative ease.

For example Michael Ashmore (1991) who taught the concept of clouds reported that the presentation of the negative examples was very successful even though the group shown them did not perform as well as those shown positive examples only. However, he notes that probably his samples were too small and that the experimental details were not conducted accurately enough which of course has to be said of most of the exercises. He learnt much about the presentation of examples through this exercise.

Emer Martin (1994) also conducted a similar experiment and found that when she was teaching the positive examples only group she couldn't be entirely certain they had grasped the concept. Therefore she would have liked to have used some negative examples as a checking device.

Many students concluded that concept learning using positive and negative examples helped them to teach better. One of them Noelle O'Kelly (1994) who split her group in to two found that those taught by positive examples did slightly better than the other group was, nevertheless, led to the view following Yudin and Kates (1963) that negative examples help only when some positive example accompanies a negative one. She also drew attention to Brayley's (1963) study which compared the merits of teaching an easy concept with all negative examples and of teaching a relatively difficult concept with all positive examples. Brayley found that the students learned the more difficult concept more rapidly than the easy concept. Like Ashmore she had doubts about her actual experiment but it is clear that the combination of her results and theory gave her considerable insights into her teaching.

Jeanne Kiernan (1994) found that the class taught by positive examples only got bored with the lesson and lethargic toward the end of the class. Other student teachers had the same experience. Many of the reports describe how the teacher involved the children in concept learning. Eibhlin Ni Chionaola (1990) described how she got her twelve and thirteen year olds to clap examples of rhythm. This showed her the value of class participation. Almost a musical brainstorm!

In spite of the fact that these students were only six or seven weeks into their training some have revealed substantial insights into learning. Like many others Alison Graham (1985) obtained a better test result from those who had been taught by positive examples only. However, from research she gleaned the point that children can define a concept correctly without understanding it. Therefore a better test of learning is to get the pupil to discriminate between examples and non-examples. When she did this she found that the higher ability pupils were better at discriminating correctly than those in the lower ability group. In both groups the class taught by positive and negative examples was superior. Sheila Hoare (1994) who also taught economics to the same age group found that the use of positive and non-examples caused deep learning.

Ursula O'Brien who taught metaphor to twelve and thirteen year olds found that her test results tended to support the findings of Johnson and O'Reilly (1969) in that it seemed that her students could learn to identify concepts without being able to define them correctly. The girls who performed best and gained the highest marks were the ones who were able not only to define and recognise metaphor but were also able to explain why a particular class of stimuli made up the concept.

Overall the responses to questionnaires support the findings of this analysis. 55% (1992 Group) and 78% (1993 group)said that it was better to give the positive examples first while 35% and 37% that it is best to alternate positive with non-examples.
In 1996 because the requirements of the exercise changed in order to try and obtain better replications many students were able to split their class into two so as to teach the concept by different methods or to teach two concepts by different methods on separate occasions. 65 (0f 104) summarised their results in response to a questionnaire. Of these 31 (just under a half) reported that while there was no actual difference in the mean scores of the tests for the two different methods the relative distributions of the scores were so different as to favour the mixed example approach. Only 4% favoured the example only approach. Nearly a half (32) reported that there was more than a 5% difference in marks in favour of the mixed approach. Only 5% found a 5% difference in marks in favour of the example only approach. This lends support to the view that from year to year each cohort of student teachers experiences similar problems and come to similar conclusions which are in line with the texts they were asked to read.

The 1992 and 1993 groups were also asked if having read a chapter in a recent book which described more modern approaches to concept teaching (Howard, 1987) they wished they had tried another method of concept learning. 77% and 75% respectively said 'no' as opposed to 22% and 18% who said 'yes'. Of these a third would have used a concept map and a few would

have used metaphors (their examples included analogies) , prototype and best example procedures.

In contrast a third of the first group said in response to a similar question that they would have changed the approach to the lesson they gave.

As indicated previously 64%and 66%of the graduates in the two samples had not considered the issues surrounding the teaching of concepts before and 60% and 82% said they had been caused to revise their approach to teaching.Most of the students found some degree of value in the exercise with 9% and 23% reporting it to have been very valuable. Only 4% found the exercise to have had no value.

Apart from the fact that student-teachers need time to reflect on the exercise during the subsequent year of their training overall, the results give indirect affirmation of the view obtained from earlier classes that many graduates do not fully understand the role of concepts and their associated frameworks in their own subjects.

Taken together the reports and the questionnaires indicate the value of the seven stage lesson plan and affirm the results of the early research on the use of examples and non-examples in teaching concepts. It has been found useful with all age groups in secondary education. The value of continuing to describe these researches in textbooks for student teachers is apparent.

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The marks are intended to be a guide to the relative importance of the sections in the calculation of the final mark.

	Assessment checklist	your own assessment	tutor's assessment
1	Statement of class details including entering characteristics (a) brief statement (gender, number, age, ability range (1);(b) show where they are in the subject (3) (c) (a) and (b) plus detailed description of the pupils(5). If you have given these details in a previous lesson plan enter this information at the top of this lesson plan. Note. If there have been any changes in respect of particular individuals (to maximum of 5 for section)		
2	Adequate statement of theoretical background (a) as would be copied in a book (3); b) showing additional insight, e.g. relationships with other theories (5); (c) showing linkage with lesson . To avoid duplication this section plan see section 5 below (7) (to maximum of 7 for section)		
3	Statement of behavioural objectives (a) imprecise (b) precise, but wanting more or less than the lesson could or can give (2); (c) process objectives provided they can be observed in respect of individuals in the class (2); (d) terminal objectives stating what the student will be able to do at the end of the class in terms of knowledge and learning skills (5) (to max of 5 for section)		
4	A test designed to assess that the objectives have been achieved (6) and that the leaning theory under evaluation has been tested (5). (to maximum of 12 for section)		
5	Schema of lesson plans showing chases, strategies and summary of contact (1c). Clearly showing how the instructional strategies relate to the problem established in the theoretical background. See section 2 above. Also see exhibit 5.9 for outline of schema. Double sided A4 may be used (to maximum of 15 for section)		
6	Evaluation showing (a) what happened in the class; (b) personal response to class (5); (c) test at a time distant from the class (see note 4); (d) simple statistics of the tests (i) mean scores (3); (ii) standard deviations (3); (e) interpretation (3) and conclusions from the tests (5); (f) reservations and assumptions (5); (g) supporting illustrations from students' work in class or the test (4);. NB If a test is not used a full justification of method of evaluation used must be given.		
7	Evaluation of the theory (3) in the light of this study and your other experience during the year		
8	Presentation (a) formal according to regulations (i.e. A4 paper on one side, margins etc) (3); (b) general literacy (e.g. grammar, explanations to the point (7). To Maximum of 7 for section).		

This assessment should not be taken to mean that the content is necessarily correct.

Exhibit 1. The assessment schedule as used by the teachers in the 1990 and 1991 cohorts. Some sections (e.g. 2) were subsequently modified to focus specifically on the requirements of the concept learning exercise.

1. Describe the performances expected of the student after the concept has been learned.
2. Reduce the number of attributes to be learned in complex concepts and make important attributes dominant.
3. Provide the student with useful verbal (visual) mediators.
4. Provide positive and negative (non) examples of the concept in terms of appropriate number and realism.
5. Present the examples in close succession or simultaneously.
6. Provide occasions for student response and reinforcement of those responses.
7. Assess the learning of the concept.

Exhibit 2. de Cecco and Crawford's (1974) seven instructional steps for concept learning.

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Class: 1st Year Science — Aids: Pictures and Objects

Ability Range: Mixed Ability Group of 21 Pupils, of Boys and Girls

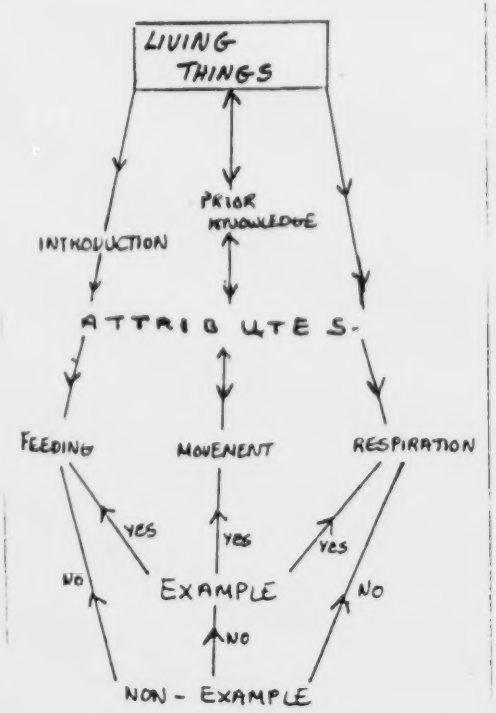
AIM	LESSON PHASES	CONTENT	LEARNING STRATEGIES
Non-Behavioural objective: To introduce concept learning to the pupils, using the concept of 'Living Things'	Introduction: Introduce the 'idea' of a concept. What do we know already? How can we use their aspects of 'Living Things' to describe them? Explain the use of attributes to describe them.	Concept:	Groups: 2 Small Groups: With a mix of boys and girls in each group. Group 1: 10 pupils will be given examples and non-examples. This group will include weak/ average ability pupils with 1 or 2 higher ability students for comparison. Group 2: 11 pupils will be given examples only. This group comprises average /higher ability pupils which will test their ability to discriminate from examples only.
Behavioural Objective: At the end of 20 minutes the pupils will be able to: ·Identify examples of 'Living Things' ·Identify examples of 'non-Living Things' ·Identify that Living Things have the attributes of Feeding, Movement and Respiration. ·Discriminate between living and non-living from the basis of the attributes of Living Things.	Presentation: Present 3 main attributes of Living Things. Explore their understanding of each of these attributes. Application (Group 1+2)I: Show 3 examples of living things. Explore if these 'fit' the attributes discussed. Application (Group 1)II: Follow examples with non-examples. Explore why they are 'non-living' in relation to the attributes. Assessment: By test one week later	 A CONCEPT MAP OF THE LESSON.	Learning Style: Expository Attributes boxed on the board and kept in view throughout class. Pictures and objects of examples and non-examples kept in view in appropriate groups.

Exhibit 3 Example of a lesson plan by a graduate student teacher for teaching a concept using two different approaches to the use of examples and non examples. (age range 12 - 13)